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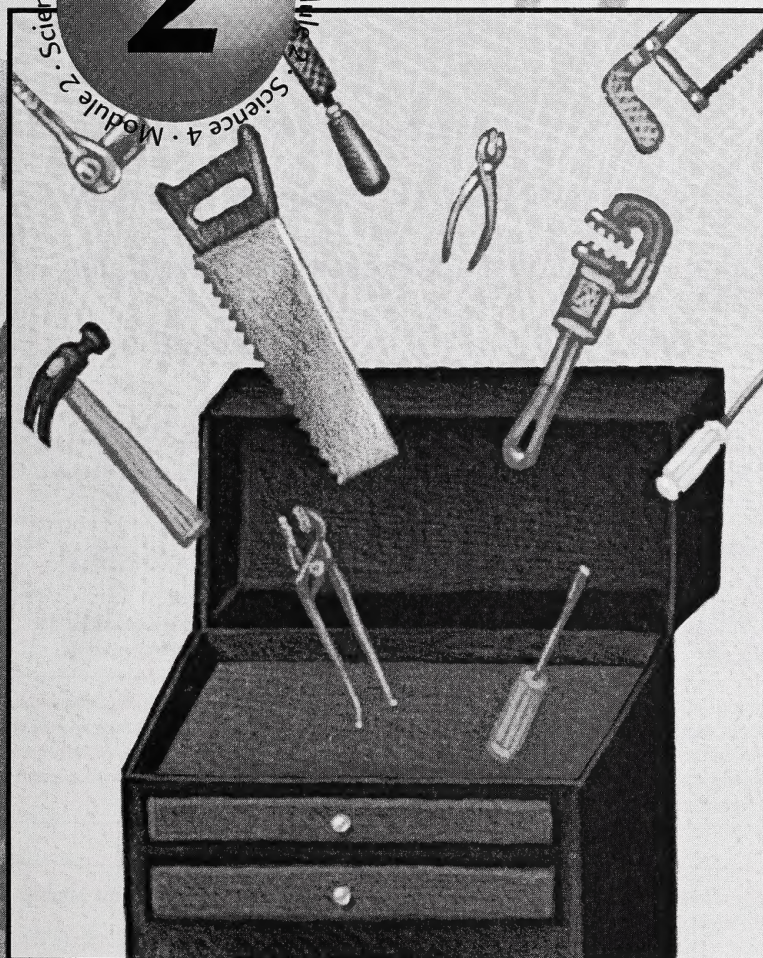


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# Science 4

Building Devices and Vehicles That Move  
Home Instructor's Guide and  
Assignment Booklet 2A

2



Alberta  
EDUCATION



Learning  
Technologies  
Branch



Science 4  
Module 2: Building Devices and Vehicles That Move  
Home Instructor's Guide and Assignment Booklet 2A  
Learning Technologies Branch  
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**The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Home Instructor's Guide and Assignment Booklet.**

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	



You may find the following Internet sites useful:

- Alberta Education, <http://www.education.gov.ab.ca>
- Learning Technologies Branch, <http://www.education.gov.ab.ca/ltb>
- Learning Resources Centre, <http://www.lrc.education.gov.ab.ca>

Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

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# Module 2: Building Devices and Vehicles That Move

## Overview

Inventors wonder if there is a better way to do something. They look for better machines or easier methods for doing things. Your student will be taking on the role of an inventor and a builder in this module. Your student will come to realise that machines can't do everything for a person, but they can do a lot. Your student should see that for every machine, someone, somewhere, had to come up with the idea. Then he or she had to design, build, and test the machine.

In this module, your student will experiment with forces that can power his or her machine. The student will find out about designing machines. He or she will also build and test a machine using the knowledge gained about simple machines.

Your student will discover that having a good idea is not all that is needed for a successful final product.

## Notes to the Home Instructor

This booklet contains the following components for you and your student:

### 1. Home Instructor's Guide

These are notes for you. First, there is an overview, a listing of suggested websites, and a listing of additional required materials needed for the section. Then, there is an overview of the content, activities, learning outcomes, and special requirements of each lesson in the section.

**Note:** To ensure that you have all of the materials on hand for your student to complete the activities for each module, read through the list of materials required for the lessons. They are boxed for easy reference, as shown in the following example.

#### Activity 1: Cleaning by Force

- about 30 mL ketchup
- 2 white or light-coloured plates
- a watch or clock that measures seconds
- access to a sink with cold running water

### 2. Assignment Record Form

This is a form to send in with the assignments. Remember to paste the address label provided by your school on it. The teacher will keep track of your student's assignments, record your student's grades, and include his or her comments using this form.

### 3. Assignment

Your student should answer all questions in complete sentences where possible. Questions set up as lists, tables, charts, or graphs do not need sentence answers. Send the assignment to the teacher as soon as the booklet has been completed.

## 4. Home Instructor Feedback Form and Student Feedback Form

You and your student should complete these forms. Send them in at the same time as the assignment. They provide us with helpful information about what we are doing right and what needs to be changed.

## 5. Checklist

The checklist helps you confirm that all of the required components have been collected prior to submitting the completed work to the teacher. For students completing this module electronically, this checklist also includes spaces to indicate the method of submitting graphs, drawings, or photos of assignment work where required.

# Section 1: Forces That Move Us

## Overview

Section 1 introduces the student to forces. The student discovers that most actions involve forces. The student also finds out that when a force is applied to an object, the object applies a force back. The student looks at wind and water applying forces to objects and also at how gravity and stored energy can apply force and cause motion.

## Assessment and Feedback

The feedback you and your student provide in the feedback forms will assist the teacher in assessing your student's progress.

The Section 1 Assignment is worth 22 marks out of the total 84 marks for this module.

## Websites Mentioned in Module 2: Section 1

It is recommended that you check these websites prior to your student beginning work on this section.

### Lesson 1

- water turbine and generator  
<http://science.howstuffworks.com/hydropower-plant1.htm>

### Lesson 3

- wind-up and gravity machines  
[http://www.vam.ac.uk/vastatic/microsites/1482\\_moving\\_toys/](http://www.vam.ac.uk/vastatic/microsites/1482_moving_toys/)

## Additional Required Materials

### Activity 1: Cleaning by Force

- about 30 mL ketchup
- 2 white or light-coloured plates
- a watch or clock that measures seconds
- access to a sink with cold running water



## Activity 2: Sliding Away

- a ramp: a flat, rectangular piece of smooth wood or heavy cardboard approximately 1 m long and 20 cm (or more) wide
- a number of pairs of small objects having the same size and shape but different weights: books, blocks, boxes, cans, and so on
- a metre-stick or metric tape measure
- a pen or pencil

## Activity 3: Driving a Spool

- a spool, preferably with notched ends (from sewing thread)
- 2 toothpicks or wooden matchsticks (one long and one short) **or** a short piece of toothpick and a bobby pin
- a rubber band (as long as the width of the spool)
- a small washer or a button with large holes
- a short piece of tape

## Optional Follow-up Activities

### Activity 1: Drop It!

**CAUTION:** The Optional Follow-up Activity requires adult supervision. After hitting the cookie sheet, the objects may bounce in unexpected ways. There is the danger of injury or damaging nearby objects. Perhaps this activity could be done outdoors away from precious things. Your student may also need support while getting onto and off the chair.

- 2 balls of different sizes and weights (could be a tennis ball and a golf ball)
- other pairs of unbreakable items of the same shape but different weights
- a cookie sheet (for the objects to land on)
- a sturdy chair

### Activity 2: Spool Races

- the spool device created in Activity 3: Driving a Spool
- a second spool device (created with similar materials or by using spools of different sizes, e.g., a spool from a roll of ribbon)

# Lesson Summaries

## Lesson 1: Wind and Water

### Summary

This lesson begins by asking your student to imagine simple, everyday actions such as opening a door or throwing a baseball. Your student will discover that these actions involve forces. Your student will also see that when a force is applied to something, it also applies a force back. For example, as your student walks down the street, he or she is applying force to the ground and the ground is applying an opposite force.

Demonstrate several examples where your student can see forces at work. Examples of forces would be running water, blowing wind, or kneading dough. In Activity 1: Cleaning by Force, your student will predict results and test whether slow- or fast-flowing water will clean an object faster.

You and your student may want to explore wind turbines and their uses in Canada. Wind turbines change wind energy into electricity. The force of the wind turns the blades of the turbine. This motion is then changed into electricity that is used in homes and businesses. The following websites talk about using natural forces to provide energy for us to use.

- [http://www.re-energy.ca/t\\_windenergy.shtml](http://www.re-energy.ca/t_windenergy.shtml)
- <http://www.canwea.ca/en/faq.html>
- <http://www.itk.ca/environment/climate-change-renewable-energy.php>

### Learning Outcomes

It is expected that your student will be able to

- investigate different kinds of forces used to move objects or hold them in place

### Additional Required Materials

#### Activity 1: Cleaning by Force

- about 30 mL ketchup
- 2 white or light-coloured plates
- a watch or clock that measures seconds
- access to a sink with cold running water



## Lesson 2: Downhill Ride

### Summary

In this lesson, your student will be exploring the gravitational force on an object, and how it moves the object down an inclined plane.

Newton's first law of motion states, "An object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force." Therefore, an object needs a force to act upon it for it to move. In this lesson, the force will be gravity.

You may want to take your student to the Science Monster website. The lunar lander game is a bit of fun and gets at inertia quite nicely.

[http://www.sciencemonster.com/gravity\\_inertia.html](http://www.sciencemonster.com/gravity_inertia.html)

The experiment your student will do in Activity 2 may need to be done a number of times to achieve a clear result. It is difficult to do this type of experiment accurately as there are many factors that will influence the results. Your student will be attempting to determine whether a heavier or lighter object needs a steeper grade on an inclined plane, to begin moving down it. You may need to help your student as doing all tasks—lifting and measuring and watching—at the same time can be very difficult.

### Learning Outcomes

It is expected that your student will

- use simple forces to power or propel a device, e.g., downhill motion
- design and construct devices that move or have moving parts

### Additional Required Materials

#### Activity 2: Sliding Away

- a ramp: a flat, rectangular piece of smooth wood or heavy cardboard approximately 1 m long and 20 cm (or more) wide
- a number of pairs of small objects having the same size and shape but different weights: books, blocks, boxes, cans, and so on
- a metre-stick or metric tape measure
- a pen or pencil



## Lesson 3: Winding It Up

### Summary

In this lesson, your student will look at devices that are powered by winding a cranking mechanism. In the past, many devices were powered this way. The first cars used a crank to start the engine, and phonographs were powered this way in the late 1800s.

If you are able to acquire some devices that have cranking mechanisms, it would be useful for your student to see the inner workings. There are some devices in use today that use this power source: large pencil sharpeners, salad spinners, watches, clocks, wind-up toys, etc.

Some cranking mechanisms directly drive the devices, such as a pencil sharpener or salad spinner. Others cause tension in an inner part of the device. The release of the tension then causes the device to have power, such as in a wind-up toy or watch.

### Learning Outcomes

It is expected that your student will

- use simple forces to power or propel a device, e.g., downhill motion
- design and construct devices that move or have moving parts

### Additional Required Materials

#### Activity 3: Driving a Spool

- a spool, preferably with notched ends (from sewing thread)
- 2 toothpicks or wooden matchsticks (one long and one short) **or** a short piece of toothpick and a bobby pin
- a rubber band (as long as the width of the spool)
- a small washer or a button with large holes
- a short piece of tape



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## ASSIGNMENT BOOKLET 2A

Science 4

Module 2: Section 1 Assignment

### Home Instructor's Comments and Questions

\_\_\_\_\_  
Home Instructor's Signature

### FOR SCHOOL USE ONLY

Assigned Teacher:  
\_\_\_\_\_

Date Assignment Received:  
\_\_\_\_\_

Grading:  
\_\_\_\_\_

Additional Information:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### FOR HOME INSTRUCTOR USE (if label is missing or incorrect)

Student File Number:  
\_\_\_\_\_  
\_\_\_\_\_

Date Submitted:  
\_\_\_\_\_  
\_\_\_\_\_

Apply Module Label Here

Name

Address

Postal Code

*Please verify that preprinted label is for  
correct course and module.*

### Teacher's Comments

\_\_\_\_\_  
Teacher's Signature

Home Instructor: Keep this sheet when it is returned to you as a record of the student's progress.

# INSTRUCTIONS FOR SUBMITTING THIS DISTANCE LEARNING ASSIGNMENT BOOKLET

When you are registered for distance learning courses, you are expected to regularly submit completed assignments for correction. Try to submit each Assignment Booklet as soon as you complete it. Do not submit more than one Assignment Booklet in one subject at the same time. Before submitting your Assignment Booklet, please check the following:

- Are all the assignments completed? If not, explain why.
- Has your work been reread to ensure accuracy in spelling and details?
- Is the booklet cover filled out and the correct module label attached?

## MAILING

1. Do **not** enclose letters with your Assignment Booklets. **Send all letters in a separate envelope.**
2. Put your Assignment Booklet in an envelope and take it to the post office and have it weighed. Attach **sufficient postage** and seal the envelope.

## FAXING

1. Assignment Booklets may be faxed to the school with which you are registered. Contact your teacher for the appropriate fax number.
2. All faxing costs are the responsibility of the sender.

## E-MAILING

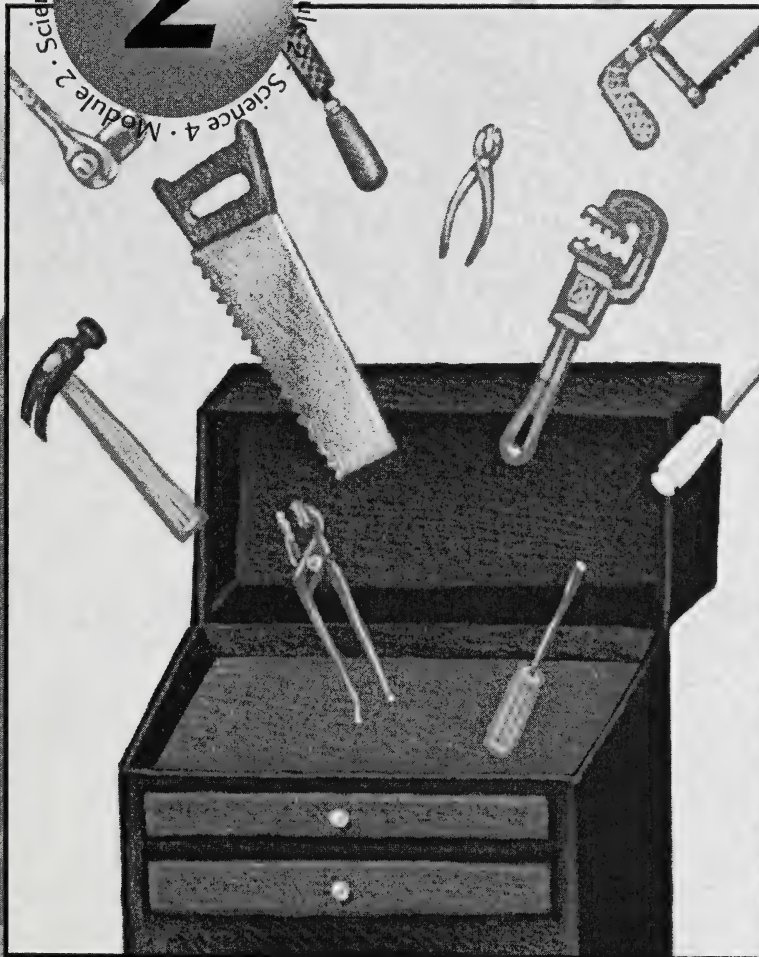
It may be possible to e-mail your completed Assignment Booklet to the school with which you are registered. You also may be **required** to e-mail some of your assignments. Contact your teacher for the appropriate e-mail address.



# Science 4

## Building Devices and Vehicles That Move Assignment Booklet 2A

2



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## FOR TEACHER'S USE ONLY

### Summary

	Total Possible Marks	Your Mark
Lesson 1 Assignment	8	
Lesson 2 Assignment	6	
Lesson 3 Assignment	8	
	22	

### Teacher's Comments

Science 4  
Module 2: Building Devices and Vehicles That Move  
Assignment Booklet 2A  
Learning Technologies Branch

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- Learning Resources Centre, <http://www.lrc.education.gov.ab.ca>

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## ASSIGNMENT BOOKLET 2A

### SCIENCE 4: MODULE 2

### SECTION 1 ASSIGNMENT

This Assignment Booklet is worth 22 marks out of the total 84 marks for the assignments in Module 2. The value of each assignment and each question is stated in the left margin.

Read all parts of your assignment carefully and record your answers in the appropriate places. If you have difficulty with an assignment, go back to your Student Module Booklet and review the appropriate lesson. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

**Note:** If you are using electronic assignments, you will need to do the following:

- You need to print the pages that ask you to make a drawing. You will find them in your PDF file.
- You will need to mail your drawings to your teacher.

22

2

### Section 1 Assignment: Forces That Move Us

1. a. What is a force?

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- ② b. Imagine that your bike is covered with dried-on mud. You are about to use a garden hose to wash off the mud. How could you wash the bike the fastest?

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- ② c. Using your understanding of forces, explain how a team can win a tug-of-war.

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- ② d. Describe how you might apply a force to stop a moving object.

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In each part of this question, your teacher will look for

- complete sentences (1 mark)
- a clear answer to the question (1 mark)



When you are ready, turn to Lesson 2 in your Student Module Booklet.



2. You have been asked to design ramps for two problems. For each problem, explain what you need to think about, and what the ramp would look like. You can draw a design with labels to help with your description.

3

- a. A student in a wheelchair is on a stage that is 2 m above the floor. The student needs to move safely from the stage to the floor.

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- b. Several boxes are in a room on the second floor of an apartment building. The boxes need to get to the ground quickly and safely.

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In each part of this question, your teacher will look for

- complete sentences (1 mark)
- a clear answer to the question (2 marks)



When you are ready, turn to Lesson 3 in your Student Module Booklet.

4

3. a. Many things were powered with a cranking mechanism in the “old days.” Using cranks is unusual today. Why do you think cranks are not used often any more?

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- b. Devices today usually use electricity, batteries, or gas to give them power. What is an advantage of using a crank or wind-up mechanism instead?

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In each part of this question, your teacher will look for

- complete sentences (1 mark)
- a clear answer to the question (3 marks)



Now return to your Student Module Booklet and read the Section 1 Conclusion and the Optional Follow-up Activities.



## Home Instructor Feedback Form

### Module 2: Section 1

Answer the following questions and mail them in with the completed assignment for this section.

1. Did your student have any difficulty with this section? If so, which parts were difficult?

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2. Approximately how many of the lessons in this section was your student able to complete within a 45- to 60-minute time frame?

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3. Was your student able to easily find the materials for the activities? Indicate any materials that were not readily available.

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Please add any questions or comments you may have.

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## Student Feedback Form

### Module 2: Section 1

Answer the following questions and mail them in with the completed assignment for this section. This is not a test, and there are no marks assigned.

1. The Internet was often mentioned in this section as an optional research tool or for further activities. Answer the questions below by placing an "X" on the line closest to your answer.

- a. How often did you use the Internet during this section?

not at all		sometimes		often		all the time
<hr/>						

- b. Think about the instructions given in this section. Did they make the Internet easy or hard to use?

very easy		rather easy		neither easy nor hard		rather hard		very hard
<hr/>								

2. What did you find the most difficult in the section?

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3. Which version of the Assignment Booklet did you use? Circle the one you used.

Print

Electronic

## Checklist for Module 2: Assignment Booklet 2A

Make sure you send in all of the following items.

- ☐ Assignment Record Form
- ☐ Assignment Booklet 2A, questions 1–3
- ☐ Home Instructor Feedback Form
- ☐ Student Feedback Form
- ☐ Optional Follow-up Activity (optional)

If you chose to use diagrams in question 2 and you are completing your Assignment Booklet electronically, advise your teacher how you are submitting the following:

Question 2.a.

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Question 2.b.

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